RADTRAN gives radiation material transportation people free method for analyzing risks, consequences

Ruth Weiner serves as project lead; 200 users worldwide

RAD wastes approach the WIPP site near Carlsbad, N.M.

By Chris Burroughs

In 1986 Sandia launched RADTRAN software to the public, giving the radiation material transportation community a new, free method for assessing risks and consequences.

Today, the code, which is much more powerful and easy to use, has 200 users throughout the world, ranging from companies that transport small medical devices containing radioactive materials to those transporting spent radioactive fuel from nuclear power plants. DOE funds the project, making it free to users.

National and international standard

"This software is the national and international standard for transportation risk assessment and consequence analysis for radioactive materials," says Ruth Weiner (6143), a one-time RADTRAN user and now project lead of the Sandia program. "It calculates potential doses of radiation to the public and transportation workers, both in normal transportation operations and as a result of an accident."

RADTRAN was originally developed in-house in 1976. Between 1977 and 1986 it ran only on Sandia computers and was used only by Sandians. The program was released to the public in 1986, free to organizations around the world that transport radioactive materials. It has gone through several upgrades, with RADTRAN 6.0 expected to launch this year. RADTRAN 5.0 came out in 2002 and was the first downloadable version of the software.

The code combines user-determined demographic, routing, transportation, packaging, materials, and radionuclide data with meteorological and health physics data to calculate expected radiological risks and consequences of transporting radioactive materials. Since its inception, it has been used in most radiological transportation environmental assessments and environmental impact statements.

Users submit an online application, and upon approval, have access to the software. They are e-mailed a user guide to assist them in the downloading process.

"RADTRAN allows users to track potential radiation releases, for example, as a truck carrying radioactive materials travels along a highway," Ruth says. "It calculates doses of radiation coming from a shipment to various populations. Those doses are usually very small."

Data collection began in 1970

RADTRAN does not make statements that shipments are unsafe, Ruth says. It only does calculations.

"We don't think we can tell members of the public that something is safe or not safe," she says. "We give them the data and they can decide for themselves."

If there is an accident, like a truck carrying radioactive materials rolling over, RADTRAN can calculate doses of consequence and risk. It looks at what can happen — the scenario; how likely it is to happen — probability; and what if it happens — the consequence.

"We've been looking at and collecting data since 1970," Ruth says. "There's never been an accident where there has been a release of radioactive material that caused ill health effects. However, there have been releases of radioactive materials."

Recently, a University of Michigan graduate student benchmarked RADTRAN with actual nuclear materials. She checked radiation emissions from three, five, and 10 meters away from the material and found that RADTRAN was slightly conservative in its dose estimates. (The student was one of Ruth's PhD candidates at the University of Michigan, where she is a part-time professor. The student was a summer intern at Sandia in 1998.)

Ruth says radioactive materials have been transported around the US since the 1950s. Most — 90 percent — are for medical and industrial uses. Radioactive packages are transported daily. Most are transported by commercial entities like FedEx. Others are large, well-shielded spent fuel casks going between nuclear power plants and to several DOE facilities in specially built trucks. Transuranic radioactive waste is carried regularly to the Waste Isolation Pilot Plant (WIPP) in Carlsbad in TRUPACT-II containers designed by Sandia.

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Training the world in RADTRAN

Also, the United States has agreements with other countries to provide them with nuclear power plant fuel. Under the agreements, the countries must return the spent fuel, which is then transported cross-country to locations such as Idaho National Laboratory.

Since Sept. 11, 2001, RADTRAN has been used to determine the consequence of a deliberate radiological attack, something that has never happened.

Ruth and Doug Osborn (6143) give regular training sessions throughout the US on how to use RADTRAN. They even travel to foreign countries to demonstrate the software.

Besides the US, RADTRAN has users in Korea, Taiwan, Japan, India, Bangladesh, and soon South Africa.

Ruth says Sandia programmers initially developed the RADTRAN program. Upgrades have been provided by both Sandians and Sandia contractors. While RADTRAN is written in Fortran, a code that isn't even taught any more, no plans are in the works to change it.

"If we switch code, we may introduce errors," Ruth says. "This is one Sandia product that has stood the test of time."

More information about RADTRAN can be found at https://radtran.sandia.gov.

Ruth Weiner is a former RADTRAN user

Ruth Weiner (6143) first became a RADTRAN user in 1989 when she was a professor of environmental studies at Western Washington University. She joined Sandia in 1995 working on WIPP and became RADTRAN project lead in June 2003.

Working with her is Doug Osborn (6143) who helps users with the software program.